

(12) **UK Patent Application** (19) **GB** (11) **2 244 422 A** (13)  
 (43) Date of A publication 04.12.1991

(21) Application No 9110014.9

(22) Date of filing 09.05.1991

(30) Priority data

(31) 02048216 (32) 09.05.1990 (33) JP  
 02142815 31.05.1990

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(51) INT CL<sup>5</sup>  
 A61F 13/15

(52) UK CL (Edition K)  
 A3V V1B3A1 V1B3A2 V1B3B

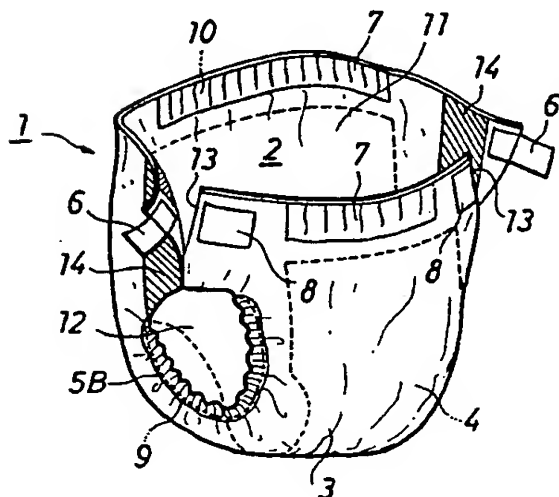
(56) Documents cited  
 GB 0636684 A GB 0515986 A GB 0499170 A  
 GB 0434345 A

(58) Field of search  
 UK CL (Edition K) A3V  
 INT CL<sup>5</sup> A41B 9/02 9/04 13/04, A41D 17/00, A61F  
 13/15

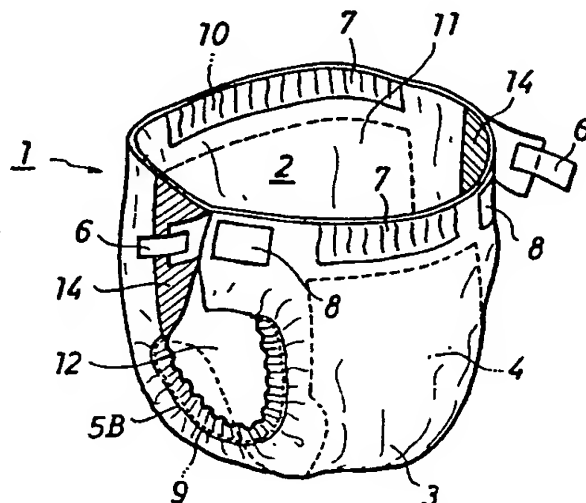
(54) **Disposable diaper**

(57) A brief type disposable diaper i.e. one which takes the form of a pair of pants comprises a liquid permeable inner sheet (2), a liquid impermeable outer sheet (3), an absorbent member (4) disposed therebetween and an elastic member (9) around each leg opening (12) for gathering the diaper around the opening. The front and rear waist body portions (7) of the diaper extend beyond the absorbent member, and are connected together over part of the distance between the leg opening on each side and the waist opening (11). Fastening means (6) (e.g. a tape) is provided on each side of the diaper to fasten together the unconnected part and/or to induce tension around the waist of a person wearing the diaper. In another embodiment, one or more horizontal slits also are provided in each side of the diaper, between the leg opening and the waist opening.

**Fig .1**



**Fig .4**



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Fig. 1

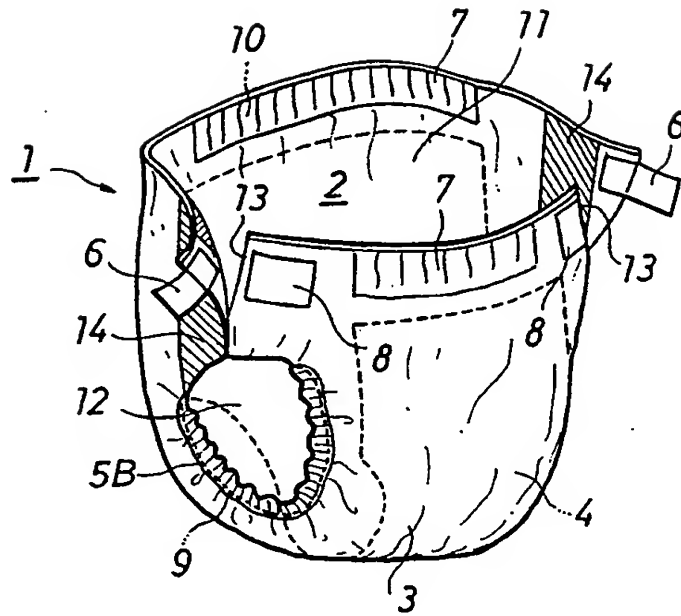


Fig. 2

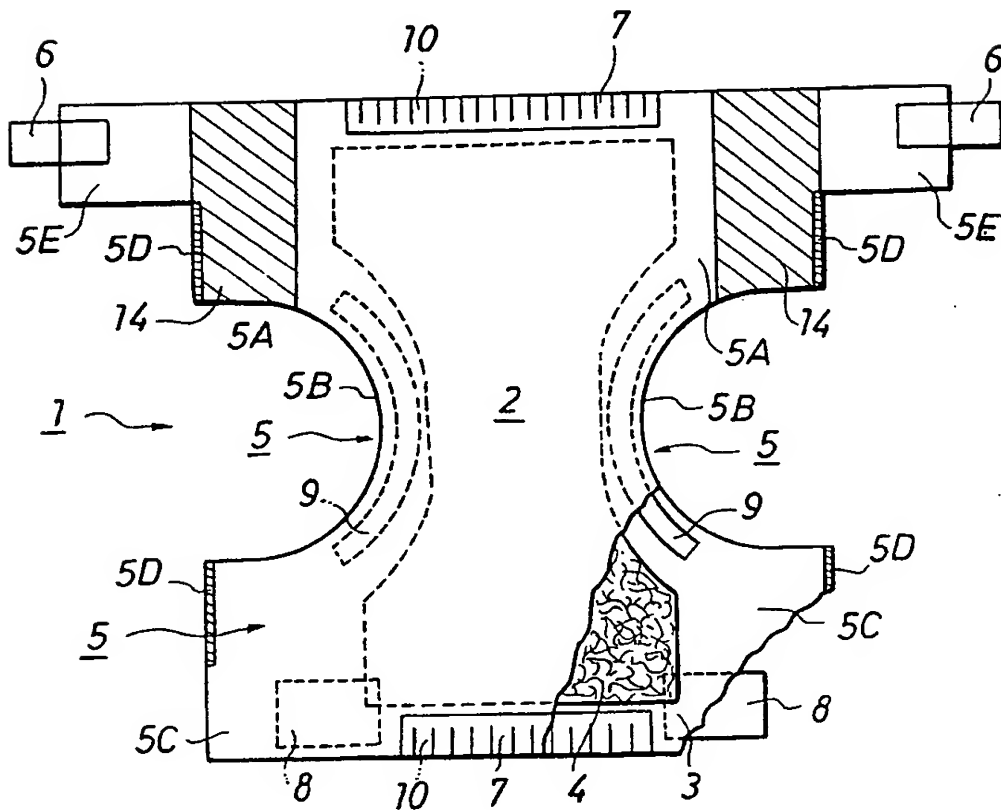


Fig .3

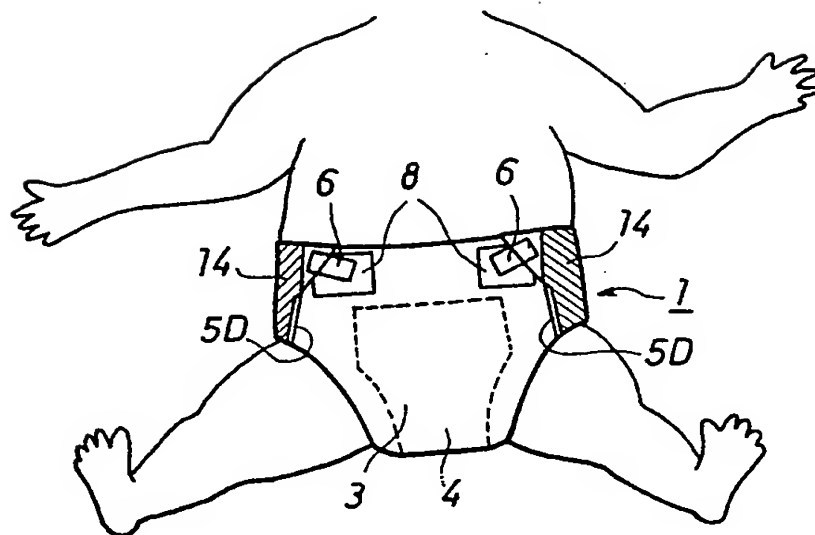


Fig .4

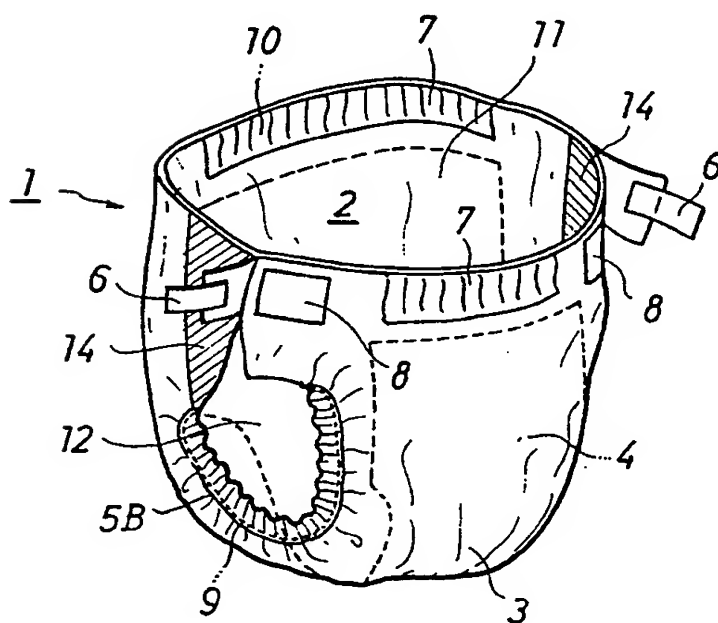


Fig . 5

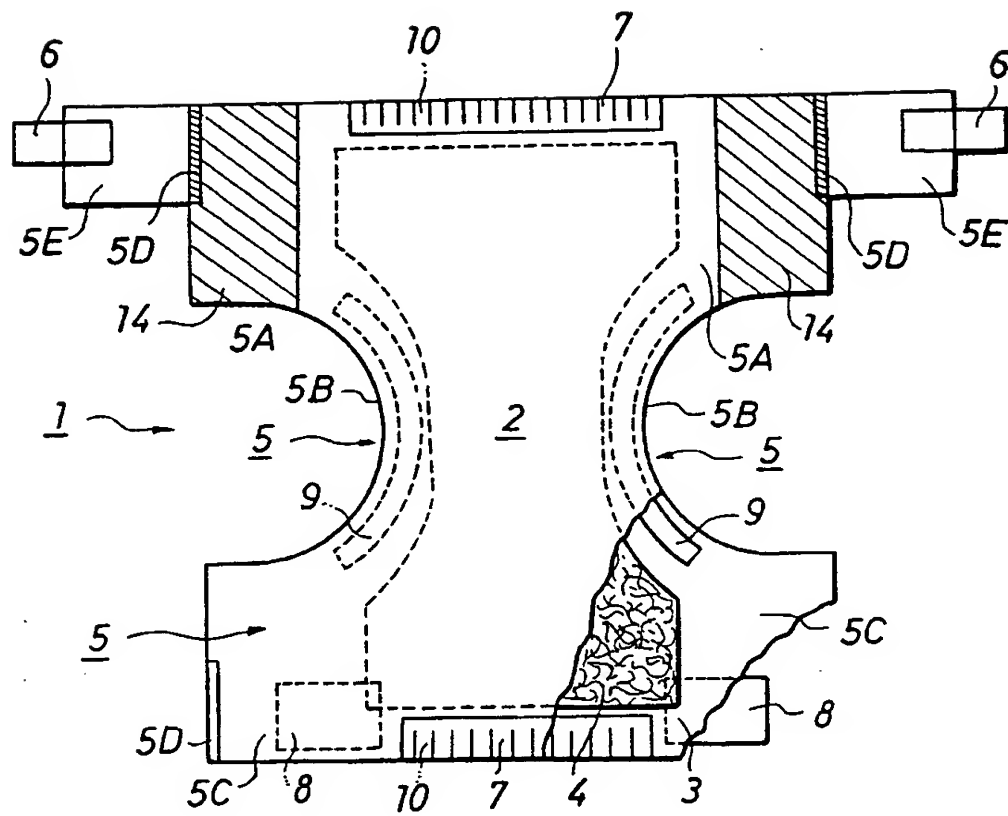


Fig . 6

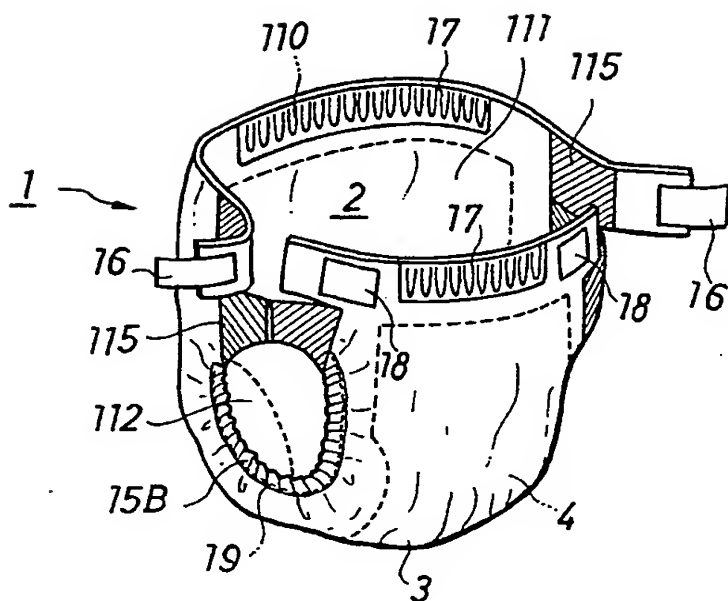


Fig . 8

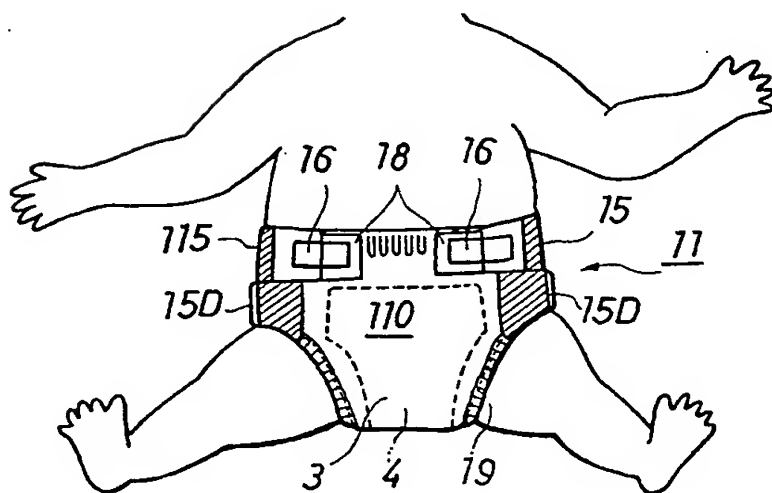


Fig. 7

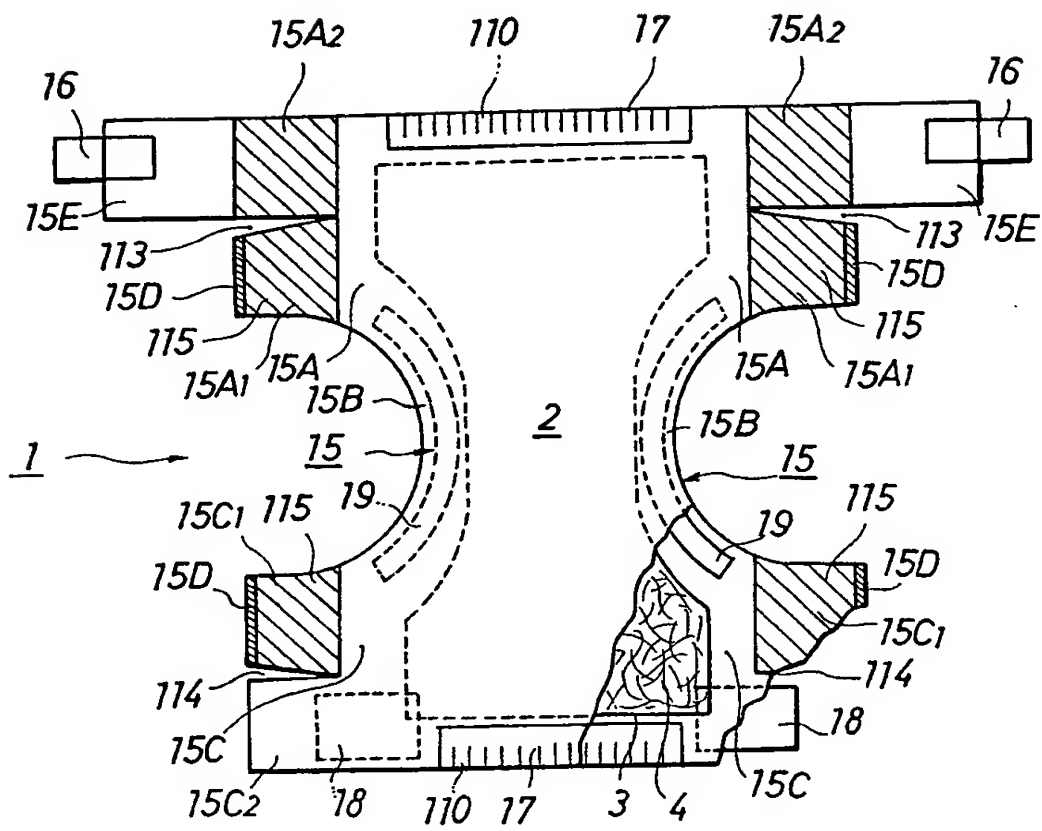
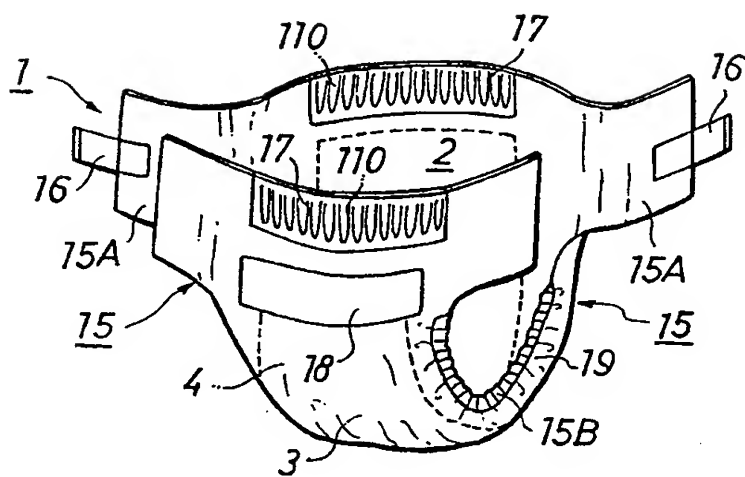








Fig .11



## DISPOSABLE DIAPER

This invention relates to a disposable diaper or nappy for infants or adults e.g. incontinent persons.

Many kinds of disposable diaper have been proposed. One typical kind of disposable diaper is the so-called flat type diaper which comprises a liquid permeable top or inner sheet, a liquid impermeable back or outer sheet and an absorbent member disposed therebetween. The diaper includes side flaps (i.e. areas of the inner and outer sheets which extend laterally beyond the absorbent member). Each side flap includes a laterally extending portion (or rear waist side portion) at the rear of the diaper, which carries a fastening tape which, in use, is fastened to the front of the diaper to secure the diaper around a wearer.

Figure 11 is a general view of one example of such a diaper. The diaper shown in Figure 11 comprises an inner sheet 2, an outer sheet 3, an absorbent member 4 and a pair of side flaps 15. The rear waist side portions 15A extend, in use, around the wearer's body and are fastened by means of tape fasteners 16 to a fastening pad 18 at the front of the diaper. Elastic members 19,110 are located in the leg portions 15B of the side flaps 15 and in the front and rear of the diaper, in the so-called waist body portions 17. The elastic members 19,110 create a good fit around the waist and legs of the wearer, when the diaper is in use. This diaper is described in Japanese Patent Publication No. Sho 52-40267.

More recently, a so-called underpants type, drawers type or brief type diaper, which takes the form of a pair of pants, has been proposed in which the corresponding side edges of the front and rear waist body portions are attached to form a waist opening and a pair of leg openings (Japanese Patent Early Laid-open Publication No. Sho 61-207606). The leg and waist openings are elasticated to provide a close fit, in use, regardless of the wearer's figure. The wearer can normally put on this diaper whilst standing up. The diaper is therefore very useful for toilet training, or for the use of incontinent persons, or adults who have difficulty in walking. This diaper also has the appearance of a sewn product, and is made for use as an item of disposable underwear.

Known brief type diapers are capable of fitting infants who are quite old and also highly active. A shortcoming of such diapers is that since the size of the waist opening is limited, it is difficult smoothly to insert an infants' legs into the diaper and the wearer often feels constricted by the diaper. When the infant is wriggling and moving his legs, it is even more difficult to fit on this type of diaper. Known brief type diapers have the further disadvantage that the wearer must adopt an awkward stance when putting on the diaper, whether the wearer is an infant or an adult.

A further disadvantage of known brief type disposable diapers is that it is not easy for someone not wearing a diaper to tell whether a diaper being worn by e.g. an infant has been soiled, and it is thus necessary to

rely on e.g. the wearer's facial expression to determine this. Moreover, since these diapers have no tape fastener, when a used diaper is wrapped up to be disposed of, it is difficult to make it secure.

An object of the present invention is to provide a disposable brief type diaper which a wearer may put on without adopting an awkward stance, and which may be put on a wearer (e.g. an infant) relatively easily even when the wearer is moving his legs rapidly. It is a further object to provide a brief type disposable diaper whose condition may easily be checked whilst it is being worn. It is also an object to provide a diaper which may be wrapped up securely for disposal after it has been used.

As a result of extensive study of brief type disposable diapers, the inventors of the present invention have found that the above object can be achieved by providing a particular configuration to the areas at each side of a diaper, where the front and rear waist body portions are connected.

According to the present invention a disposable diaper in the form of a pair of briefs with a waist opening and two leg openings has a liquid permeable inner sheet, a liquid impermeable outer sheet, an absorbent member located between them and an elastic member extending at least partly around each leg opening to gather the diaper around the leg opening, the front and rear waist body portions of the diaper being connected together on each side of the diaper over only part of the distance between the waist opening and each leg

opening and being unconnected over the remainder of the said distance, fastening means being provided on each side of the diaper to fasten together the front and rear waist portions over some or all of the distance over which the waist body portions are unconnected and/or to tighten the front and rear waist body portions around the waist of the person wearing the diaper.

Such a diaper has the advantages of a conventional flat type diaper, which is easily adjustable to provide a good fit around the wearer's waist, and the advantages of a conventional brief type diaper which is capable of being put on a wearer whilst the wearer is standing up. This diaper is also considerably more easy to put on than a conventional brief type diaper because the waist and/or leg openings may be opened up to insert the wearer's body and/or legs respectively. Furthermore, this diaper is adjustable to fit a large range of sizes of wearer. Known brief type diapers tend to be too loose, resulting in the diaper coming off, or too tight, resulting in the wearer feeling constricted, unless the diaper is exactly the right size for the wearer. This of course necessitates providing a large range of sizes of diaper, which is not necessary with the diaper of the present invention.

Preferably, an elastic member is located in each said area between the waist opening and the leg openings, so that a tension around the waist of a wearer may be provided, without unduly constricting the wearer. Preferably also, the fastening means are positioned adjacent the waist opening, so that tension may be

induced around the top of the diaper.

The distance over which the front and rear waist body portions are unconnected may extend from the waist opening towards the leg openings and/or may extend from the leg openings towards the waist opening. In either case, the fastening means may be located in the connected region or the unconnected region on each side of the diaper. If it is in the unconnected region, the diaper may be tightened around the wearer by overlapping the unconnected edges and fastening them down using the fastening means. If it is in the connected region, the diaper may be tightened around the wearer by overlapping the unconnected edges and retaining them in place by forming a fold in the connected region which is fastened down by the fastening means.

Part of the area on each side of the diaper between each leg opening and the waist opening may be physically separated, e.g. by a substantially horizontal slit or elongate opening into at least two vertically adjacent regions, the front and rear waist body portions being unconnected in at least one of the said regions and connected in the remaining region or regions.

This arrangement has the advantage that different tensions may be induced in the upper parts and lower parts of the waist body portions. Thus, the upper parts of the waist body portions may be tightened around the waist of a wearer without distorting the leg openings. The elastic fit of the leg openings around

the wearer's legs is thus not interfered with by the tension in the waist of the diaper.

Another advantage of this arrangement is that, if there is an unconnected region adjacent the waist and/or leg openings, these openings may be widened very substantially to put the diaper on a wearer, because the unconnected regions may be folded back a relatively long way.

Preferably the said at least one region on each side of the diaper in which the front and rear waist body portions are unconnected is elasticated. The said connected region or regions may alternatively or in addition be elasticated. The fastening means may also be elasticated. Advantageously the front and/or rear side waist portions are provided with elastic members adapted to gather the diaper.

Further features and advantages of the present invention will be apparent from the following description of five specific embodiments of diaper, given by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of the first embodiment of disposable diaper in accordance with the invention;  
Figure 2 is a plan view, partly cut away, of the diaper of Figure 1, in a semi-finished state;  
Figure 3 is a perspective view of the diaper of Figure 1 on an infant;  
Figure 4 is a perspective view of the second embodiment of disposable diaper;

Figure 5 is a plan view, partly cut away, of the diaper of Figure 4, in a semi-finished state;

Figure 6 is a perspective view of a third embodiment of disposable diaper;

Figure 7 is a plan view, partly cut away, of the diaper of Figure 6, in a semi-finished state;

Figure 8 is a perspective view of the diaper of Figure 6 on an infant;

Figure 9 is a plan view, partly cut away, of a fourth embodiment of a diaper, in a semi-finished state; and

Figure 10 is a plan view of a fifth embodiment of diaper, in a semi-finished state.

Referring firstly to Figures 1 to 3, the first embodiment of diaper in accordance with the invention is a drawers type or brief type disposable diaper which takes the form of a pair of underpants. The diaper comprises a liquid permeable top or inner sheet 2, a liquid impermeable back or outer sheet 3 and an absorbent member 4 disposed between them.

The majority of the diaper may be notionally divided into a portion over which the absorbent member 4 extends (see Figures) and a portion on each side of the diaper to which the member 4 does not extend. The portions on each side are termed side flaps and have been assigned the numeral 5 for the description of the first embodiment. The side flaps 5 each consist of three portions; a rear waist side portion 5A, a leg portion 5B and a front waist side portion 5C.

The diaper may also be notionally divided into a generally annular region which in use encompasses the



wearer's torso, and a crotch region which in use extends between the wearer's legs. The annular region consists of front and rear waist body portions 7.

The front and rear waist side portions 5C and 5A thus constitute part of the front and rear waist body portions 7, respectively.

Accordingly, the expression "side flap" used in this specification refers to the portions of the diaper extending laterally outwardly from each side edge of the absorbent member. The expression "waist body portion" refers to a portion which, in use, extends half-way around the wearer's torso (designated 7 or 17 in the drawings) and the expression "waist side portion" refers to a portion of a side flap which also comprises part of a waist body portion 7.

The front and rear waist body portions 7 are connected together at each side: a waist opening 11 and a pair of leg openings 12 are thus formed. Side flaps 5 comprise the portions of the inner sheet 2 and outer sheet 3 which together extend laterally beyond the side edges of the absorbent member 4, adjacent each other. Referring to Figure 2 and the semi-finished diaper therein, the leg portions 5B of the side flaps 5 are curved inwardly in the crotch area of the diaper.

An elastic member 9 is located in each side flap 5, in the leg portion 5B, to form a gathered region. A further elastic member 10 is located in each of the front and rear waist body portions 7, in an area to which the absorbent member 4 does not extend.

The area between each leg opening 12 and the waist opening 11 has a vertical slit 13 extending from the edge of the waist opening 11 to a point approximately half-way between the leg opening 12 and the waist opening 11. Connection means, in this case a tape fastener 6 and a viscous or adherent fastening pad 8, are provided in the vicinity of each slit 13. The tape fasteners 6 are located on each side of the rear waist body portions 7, i.e. the waist body portion to the rear of the slits 13, and are, in use, fastened to the fastening pads which are located on each side of the front waist body portions 7. The tape fasteners 6 preferably comprise a pressure sensitive adhesive tape, with sufficient adhesive strength to prevent the tape being inadvertently peeled off from the fastening pads 8 while the wearer is wearing the diaper. The adhesive strength is preferably between 5.89 N (600 grams force) and 29.4 N (3000 grams force) or more for every 2.54 centimetres (1 inch) of width of tape. More preferably, the adhesive strength is between 9.81 N (1000 grams force) and 19.6 N (2000 grams force) for every 2.54 centimetres (1 inch) of width of tape.

Referring particularly to Figure 2, and the semi-finished diaper shown therein, extending continuously along the side edge of the lower half of each of the waist side portions 5A, 5C is an attachment portion 5D. In the finished diaper, the attachment portions on each side of the front waist body portions 7 are connected to corresponding attachment portions on the rear waist body portion 7. The upper half of the waist side portions of the front waist body portion 7

are not connected to the corresponding portions of the rear waist body portion 7, in the finished diaper. Thus, slits 13 are defined between corresponding waist side portions on the front waist body portion 7 and rear waist body portion 7. A fastening flap 5E extends laterally from the non-connected portion (i.e. the upper half) of each waist side portion 5A of the rear waist body portion 7 and each fastening flap 5E is provided with a tape fastener 6. The attachment portions 5D may be inclined outwardly as one moves in a direction away from the leg portions 5B in Figure 2 (this modification is not shown). In this modification, the diameter of the finished diaper increases towards the opening. Alternatively, or in addition, when the finished diaper is put on a wearer, it may be fastened in such a manner that the diameter of the diaper increases towards the opening. The attachment portion 5D is preferably 2 to 100 millimetres in length and more preferably 15 to 50 millimetres. The length of the fastening flap 5E beyond the attachment portion 5D is preferably 5 to 100 millimetres, more preferably 20 to 70 millimetres and most preferably 25 to 50 millimetres. The tape fastener 6 may be equal in length to the length of the fastening flap 5E and is more preferably shorter than the length of the fastening flap 5E.

Elastic members 14 are located at the rear waist side portions 5A of the respective side flaps 5. The elastic members 14 are preferably expansible laterally, i.e. in the direction around the wearer's waist.

The absorbent member 4 of the finished diaper has an

hourglass shape which is deformed in the crotch area. The inner sheet 2 and outer sheet 3 are shaped in conformity with the shape of the absorbent member 4 as described above. As is shown in Figure 2, the elastic members 9 are stretched and fitted around the edges of the leg portions 5B of the respective side flaps 5. The elastic members 9 are interposed between the inner and outer sheets 3 and 5. The elastic members 9 contract in the absence of any restraining force, to form gathers as shown in Figure 1. The gathered regions enhance the fit in the crotch area. Two or more tape fasteners 6 may be provided on each of the fastening flaps 5E. The inner sheet 2 used in the disposable diaper 1 of this embodiment is liquid permeable to allow waste material to pass through it and into the absorbent member 4. The inner sheet 2 preferably has a texture similar to that of conventional underwear. Examples of suitable materials for the inner sheet include woven fabrics, non-woven fabrics, perforated films and the like. To prevent leakage of waste material such as urine and the like through the edge portion of the inner sheet, a water repellent treatment may be applied to the edge portion of the inner sheet. The treatment may comprise applying a hydrophobic compound such as a silicon series oil solution, paraffin wax or the like, or applying a hydrophilic compound such as an alkyl phosphoric ester to the edge of the top sheet and then cleaning the edge with hot water.

The outer sheet 3 is preferably moisture or vapour permeable and liquid impermeable, i.e. it allows vapour to pass through it. It is preferably formed of a

thermoplastic resin with a filler added thereto and then stretched; more preferably, it also has a texture similar to that of conventional underwear. Examples of such liquid impermeable materials include composite materials of film and woven fabric or composite materials of film and non-woven fabric.

The absorbent member 4 of this embodiment preferably comprises an open cell pulp as its principal component material and a high molecular weight water absorbent polymer as a secondary material, or alternatively a mixture of a thermoplastic resin, a cellulosic fibre and a high molecular weight water absorbent polymer which has been subjected to heat treatment. The high molecular weight water absorbent polymer may comprise an upper layer in the absorbent member, or an intermediate layer or a lower layer, and/or it may be mixed with pulp. The high molecular weight water absorbent polymer is preferably capable of absorbing and retaining more than 20 times its own weight of liquid. It also preferably is granular and capable of being gelled. Examples of such high molecular weight water absorbent polymers include a starch-acrylic (salt) graft copolymer, a saponified material of starch-acrylonitrile copolymer, a bridged material of sodium carboxymethylcellulose, an acrylic (salt) polymer and the like.

The elastic members 9,10 of this embodiment are preferably rubber, either yarn-like or with a flattened cross-section, or the members may be made from a film type rubber. The elastic members preferably exert a force of 70 to 100 grams force when stretched 100% The

elastic members 14 are preferably made from a non-woven fabric which is expansible and can breathe.

When the diaper is put on, for example, an infant, the waist opening 11 is first opened out by means of the slits 13 and then the waist opening 7 is further opened out by stretching the elastic members 14. The legs of the infant are then inserted into the leg openings 12 and the sides of the slits 13 are pulled nearer together. The fastening portions 5E are pulled across the front waist body portion 7 and tape fasteners 6 are pressed onto the fastening pads 8.

Thus the diaper can easily be put on a wearer without compelling the wearer to adopt an awkward stance. Even when the wearer is highly active and is e.g. moving his legs rapidly, the diaper can easily be put on the wearer because it is simple to insert his legs through the widely spread waist opening 11. The condition of the inside of the diaper can easily be assessed since the diaper may simply be loosened by unfastening the tape fasteners 6 from the fastening pads 8 thus allowing the inside of the diaper to be inspected without actually removing it. Furthermore, when the diaper 1 contains waste material, the waste can simply be wrapped up inside the diaper and the resulting parcel secured using the tape fasteners 6, ready for immediate disposal.

Referring now to Figures 4 and 5, the second embodiment of disposable diaper is similar in all respects to the first embodiment except firstly that each vertical slit 13 starts at a leg opening 12 and extends towards the

waist opening 11, ending half-way between the respective leg opening 12 and the waist opening 11, rather than starting at the waist opening. A pair of tape fasteners 6 is provided adjacent the waist opening 11, on each side of the diaper, as shown in Figures 4 and 5. Therefore, since the leg openings 12 may be opened up because of the slits, the legs of a wearer can easily be inserted into the leg openings 12 and the diaper feels comfortably loose when it is worn. The second embodiment also benefits from the advantages already mentioned above in connection with the first embodiment.

It should be noted that the positions of the slits and connection means are not limited to those disclosed in connection with the embodiments, and variations within the scope of the claims are envisaged.

Referring now to Figures 6 to 8, the third embodiment of the diaper comprises a liquid permeable inner sheet 2, which, in use, contacts the wearer's skin, a liquid impermeable outer sheet 3 and an absorbent member 4 disposed and fixed in position between the sheets 2 and 3, which is adapted to absorb the waste material. Side flaps 15 extend laterally beyond each side edge of the absorbent material 4. The side flaps comprise portions of the inner sheet 2 and outer sheet 3 which together extend laterally beyond the side edges of the absorbent member 4, adjacent each other. Referring to Figure 7 and the semi-finished diaper therein, the leg portions 15B of the side flaps 15 are curved inwardly in the crotch area of the diaper. An elastic member 19 is located in each of the leg portions 15B of the side

direction, e.g. at the attachment portions 15D. The disposable diaper 1 can thus easily be taken off and disposed of, without the risk of soiling the wearer's skin whilst removing the diaper. The elastic members 115 preferably extend over the entire length of the respective rear flap elements 15A<sub>1</sub>, 15A<sub>2</sub> and also over at least part of the width of the respective flap elements.

It is preferable that the attachment portions 15D are made from a material which may be bonded for example, using hot melt adhesive or ultrasonic bonding, and remains soft to the touch even after being bonded (welded). The length (i.e. in the finished diaper, the vertical extent) of each of the attachment portions 15D is preferably 2 to 100 millimetres and more preferably 15 to 50 millimetres.

Fastening flaps 15E are attached to the side edges of the upper rear flap elements 15A<sub>2</sub> and extend laterally beyond the side edges of the flap elements 15A<sub>2</sub>. The fastening flaps 15E are provided with fastening means (tape fasteners) 16 and the tape fasteners 16 may be fastened, in use, to fastening pads 18 provided on each side of the front waist body portion 17, when the finished diaper is put on a wearer. The length of the adhesive surface of each tape fastener 16 is preferably equal to or less than the lateral extent of the respective fastening flap 15E beyond the side edge of the associated waist side portion. The tape fasteners 16 preferably comprise pressure sensitive adhesive tape, with sufficient adhesive strength to prevent the tape being inadvertently peeled off the fastening pads

flaps 15. A further elastic member 110 is located in each of the rear waist body portion 17 and the front waist body portion 17. The corresponding sides of the front and rear waist body portions are connected together to form a waist opening 111 and a pair of leg openings 112.

Referring again to Figure 7 and the semi-finished diaper therein, the rear waist side portions 15A of the side flaps 15 each have a laterally extending slit 113. The rear waist side portions 15A are thus each divided into lower and upper rear flap elements 15A<sub>1</sub>, 15A<sub>2</sub>, respectively. The front waist side portions 15C are also each provided with a similar lateral slit 114, so that each front waist side portion 15C is divided into lower and upper front flap elements 15C<sub>1</sub>, 15C<sub>2</sub>, respectively. The lower rear flap elements 15A<sub>1</sub> and the lower front flap elements 15C<sub>1</sub> i.e. the flap elements nearest the leg portions 15B, are connected together in the finished diaper at the respective attachment portions 15D on the side edge of each flap element. A waist opening 111 and a pair of leg openings 112 are thus formed (see Figure 6).

It is preferable that elastic members 115 are located on each rear flap element 15A<sub>1</sub>, 15A<sub>2</sub>, extending over the entire flap element. The rear flap element 15A<sub>1</sub>, 15A<sub>2</sub> can thus expand and contract independently of each other. The elastic members 115 are preferably expansible laterally, i.e. in the direction around the wearer's waist, when the finished diaper is in use. In the finished diaper, the rear waist side portions 15A are preferably capable of being torn in the vertical



18 while a wearer is wearing the diaper. The adhesive strength, when the tape is pulled in a direction in the bonding plane, is between 5.89 N (600 grams force) and 29.4 N (3000 grams force) or more for every 2.54 centimetres (1 inch) of width of bonded tape. More preferably, this strength is between 9.81 N (1000 grams force) and 19.6 N (2000 grams force) for every 2.54 centimetres (1 inch) of bonded tape. The tape fastener 16 which is also preferably expansible: this means that the disposable diaper 1 can be more easily put on a wearer and the fastening force of the tape fastener 16 can be adjusted easily. The material of which the tape is made is preferably expansible by 30 to 400%, when subjected to a tensile force of 1000 to 1500 g/cm. To ensure a good fit around the wearer's waist, the permanent distortion of the elastic member, when it is 100% stretched, is preferably 30% or less. The lateral extent of the fastening flap 15E beyond the side edge of the associated waist side portion is preferably 5 to 100 millimetres, more preferably 25 to 50 millimetres.

The absorbent element 4 of the finished diaper has an hourglass shape which is deformed in the crotch area. The inner sheet 2 and outer sheet 3 are shaped in conformity with the shape of the absorbent member 4 as described above. Referring again to Figure 7 showing the semi-finished diaper, elastic members 19 are stretched and fitted around the edges of the leg portions 5B. The members 19 are located between the sheets 2 and 3. In the absence of any restraining force, these elastic members 19 contract to form gathers (as shown in Figure 6), to enhance the fit in the crotch area when the finished diaper is worn. Two

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or more tape fasteners 16 may be provided on each of the fastening flaps 15E. The materials used in the third embodiment for the inner sheet 2, outer sheet 3, absorbent member 4, elastic members and any other components of diaper, are the same as those used in the corresponding parts of the first embodiment. The same is true of the remaining embodiments described in this specification. The elastic member 115 preferably comprises a non-woven fabric of the type which is expansible and breathable.

When putting the diaper on a wearer, the tape fasteners 16 are first spread outwardly from the diaper to widen the waist opening 111 (see Figure 6), then the elastic member 115 on the connected lower front and rear flap elements 15A<sub>1</sub>, 15C<sub>1</sub> is manually stretched to further open up the opening 111, and the legs of the infant are inserted into the leg openings 112. Thereafter the fastening flap 15E at the sides of the rear waist body portion 17 are manually pulled over the corresponding upper front flap elements 15C<sub>2</sub> and then the tape fasteners 16 are pressed onto the fastening pads 18.

Accordingly, the disposable diaper of this embodiment can easily be put on a wearer. Since the waist opening 111 and the leg openings 112 are wide, particularly before the tape fasteners 16 are fastened, the disposable diaper 1 can easily be put on the wearer without compelling the wearer to adopt an awkward stance. Even when the wearer is highly active and is e.g. moving his legs rapidly, the disposable diaper can easily be put on the wearer because it is simple to insert his legs through the widened waist opening 111.

The entire periphery of each leg opening 112 is elasticated, by means of the elastic members 19 and the elasticated lower flap elements 15A<sub>1</sub> and 15C<sub>1</sub>. The periphery of each leg opening is thus expansible independently of the waist opening 111. The expansibility of the waist opening is provided by the tape fasteners 16, the elastic members 110 and the upper rear flap elements 15A<sub>2</sub>. A good seal around the wearer's legs is thus ensured. It should be noted that a disposable diaper is already available in which all or part of the area between the waist opening and the leg opening on each side of the diaper comprises a single elastic member. In this type of diaper, the forces exerted on the elastic members in the vicinity of the leg openings, caused by movement of the wearer's legs e.g. whilst walking, are transmitted to the areas of the elastic members in the vicinity of the waist opening. As a result, the diaper tends to slip off. Alternatively, the distance around the waist opening may change as the wearer's general body position and/or stance changes, and this is transmitted from the areas of the elastic members near the waist opening to the areas near the leg openings. Again, this may result in the disposable diaper slipping off. In the disposable diaper 1 of this embodiment of the invention, however, since the waist opening 111 and leg openings 112 may expand and contract independently, this problem does not occur. Moreover, different materials having different coefficients of elasticity may be used for the elastic members 115 on the lower flap elements 15A<sub>1</sub> and 15C<sub>1</sub> and for the upper rear flap elements 15A<sub>2</sub>. The fit of the disposable diaper 1 may thus be optimised.

The condition of the inside of the disposable diaper 1 of this embodiment can easily be determined by unfastening the tape fasteners 16 from the fastening pads 18. Furthermore, the connected lower flap elements  $15A_1$ ,  $15C_1$  can easily be torn apart in the vertical direction, and the diaper thus need not be pulled down to the wearer's feet in order to take it off. Consequently there is no risk of the wearer's skin or clothing being soiled with waste material when the diaper is removed. Also, when the disposable diaper 1 contains waste material, it can easily be wrapped up and secured with the tape fasteners for immediate disposal.

Referring now to Figure 9, which shows, semi-finished, a fourth embodiment of diaper, this diaper has upper and lower rear flap elements  $15A_1$ ,  $15A_2$  which are longer than the equivalent elements of the third embodiment. The front waist side portions 15C are not divided as in the third embodiment. Thus, the total length, i.e. lateral extent, of the lower rear flap element  $15A_1$  and the front waist side portion 15C in this embodiment is approximately equal to the total length, i.e. lateral extent, of the lower rear flap element  $15A_1$  and the lower front flap element  $15C_1$  in the third embodiment. In the finished diaper of the fourth embodiment, the lower rear flap elements  $15A_1$  are connected to the corresponding front waist side portions 15C. Elastic members 115 are located on the rear flap elements  $15A_1$ ,  $15A_2$ , to impart expansibility to the elements, and preferably extend over the entire length i.e. lateral extent thereof and also over at

least part of the width thereof. The width of the rear flap elements is preferably 5 to 150 millimetres and more preferably 30 to 80 millimetres. The absorbent member 4 is relatively wide at the rear of the diaper and the remainder has a smaller, constant width. Two elastic members 19 in the form of strips are disposed adjacent each side edge of the absorbent member 4. A single fastening pad 18 extends across substantially the entire lateral extent of the front waist body portion 17. The disposable diaper 1 of this embodiment may also be designed such that the lower rear flap elements  $15A_1$  are, in the finished diaper, directly attached to the outer sheet 3 and/or inner sheet 2 adjacent the side edges of the absorbent member 4. The disposable diaper 1 of this embodiment functions in a similar way and displays similar advantages to the diaper of the preceding embodiment.

Referring now to Figure 10, which shows a fifth embodiment of diaper in a semi-finished state, in this embodiment, the rear waist side portions 15A may each be notionally divided into three portions: a lower rear flap element  $15A_1$ , a central rear flap element  $15A_2$  and an upper rear flap element  $15A_3$ . A fastening flap 15E extends laterally from each of the lower and upper rear flap elements  $15A_1$ ,  $15A_3$ . Each fastening flap 15E is provided with tape fasteners 16A, 16B, respectively. The central rear flap elements  $15A_2$  each have an attachment portion 15D which, in the finished diaper, is connected to a corresponding attachment portion 15D on the corresponding front waist side portion. Each of the rear flap elements  $15A_1$ ,  $15A_2$  and  $15A_3$  comprises an elastic member which is also breathable. The upper

rear flap elements 15A<sub>3</sub> are formed from one piece of elastic material which extends across the full width of the rear waist body portion 17 and which also provides a gathered region in the rear waist body portion 17. All the remaining parts are the same as in the previous embodiments. Accordingly, the disposable diaper 1 of this embodiment functions in the same way and has similar advantages to the previous embodiments. In addition, since two pairs of tape fasteners are used, the fastening portion is relatively long and the diaper is thus suitable for use with adults, e.g. incontinent persons.

The disposable diaper 1 of this embodiment functions effectively if the rear waist side portions are each physically divided by at least one laterally extending slit, so that each rear waist side portion is physically divided into at least two rear flap elements, with at least one rear flap element on each side of the diaper being connected to the front waist body portion 17 to form a waist opening and a pair of leg openings. The non-connected rear flap elements are each provided with fastening means. In a diaper of this embodiment which is for the use of infants, the lower rear flap elements 15A are preferably connected in the finished diaper. In a diaper which is for the use of adults, the rear waist side portions are preferably each physically divided into three flap elements, and two of these are provided with tape fasteners. Such a design fits along the length of the wearer's body very well and provides a comfortable fit. It should be noted, however, that the number of slits, the number of fastening means, the length of the flap

elements, etc. are not limited to what is disclosed in connection with the embodiments, and variations within the scope of the claims are envisaged.



CLAIMS

1. A disposable diaper in the form of a pair of briefs with a waist opening and two leg openings, the diaper having a liquid permeable inner sheet, a liquid impermeable outer sheet, an absorbent member located between them and an elastic member extending at least partly around each leg opening to gather the diaper around the leg opening, the front and rear waist body portions of the diaper being connected together on each side of the diaper over only a part of the distance between the waist opening and each leg opening and being unconnected over the remainder of the said distance, fastening means being provided on each side of the diaper to fasten together the front and rear waist body portions over some or all of the distance over which the waist body portions are unconnected and/or to tighten the front and rear waist body portions around the waist of a person wearing the diaper.

2. A disposable diaper as claimed in claim 1 wherein an elastic member is located in each said area between the waist opening and the leg openings.

3. A disposable diaper as claimed in claim 1 or claim 2 wherein the fastening means are positioned adjacent the waist opening.

4. A disposable diaper as claimed in any one of the preceding claims in which the said distance over which the front and rear waist body portions are unconnected

extends from the waist opening towards the leg opening.

5. A disposable diaper as claimed in any one of claims 1 to 3 in which the said distance over which the front and rear waist body portions are unconnected extends from the leg opening towards the waist opening.

6. A disposable diaper as claimed in claim 1 wherein at least part of the area on each side of the diaper between each leg opening and the waist opening is physically separated into at least two vertically adjacent regions, the front and rear waist body portions being unconnected in at least one of the said regions and connected in the remaining region or regions.

7. A disposable diaper as claimed in claim 6 in which the said at least one region on each side of the diaper in which the front and rear waist body portions are unconnected is elasticated.

8. A disposable diaper as claimed in claim 6 or 7 in which the said connected region or regions is or are elasticated.

9. A disposable diaper as claimed in claim 6, 7 or 8 in which the fastening means are elasticated.

10. A disposable diaper as claimed in any one of claims 6 to 10 in which the front and/or rear side waist portions are provided with elastic members adapted to gather the diaper.

11. A disposable diaper substantially as herein specifically described with reference to Figures 1 to 3, 4 and 5, 6 to 8, 9 or 10.